What is claimed is:

1. A method of forming a tapered evanescent coupling region for use with a relatively thin silicon optical waveguide layer, the method comprising the steps of:

a) providing a polished silicon substrate including a top major surface and an opposing bottom major surface;

b) depositing a photoresist material across the top major surface of the silicon substrate provided in step a);

c) patterning said photoresist surface to define a tapered area of photo resist material;

d) etching the patterned surface to transfer the tapered pattern from the photoresist into the underlying silicon substrate material, forming a tapered opening in the silicon substrate; and

e) filling the tapered opening with a material exhibiting a lower refractive index than the silicon substrate, said filled region defining the tapered evanescent coupling region.

2. The method as defined in claim 1 wherein in performing step a), a silicon substrate having a <100> oriented crystallographic surface is provided.

3. The method as defined in claim 1 wherein in performing step a), a silicon substrate having a refractive index greater than or equal to the refractive index of the silicon waveguide is provided.

4. The method as defined in claim 1 wherein in performing step c), gray-scale lithography is used to form the tapered area of photoresist material.

5. The method as defined in claim 1 wherein the method further comprises the steps of:

f) depositing a photoresist material across the bottom major surface of the silicon substrate;

g) patterning said photoresist surface to define locations of optical coupling facets;

h) etching said patterned surface to form optical coupling facets through the bottom major surface of the silicon substrate.

6. The method as defined in claim 5 wherein an anisotropic wet chemical etch is used in the etching process of step h).

7. The method as defined in claim 5 wherein the etching process of step h) continues through the extent of the silicon substrate to the top major surface, forming prism couplers exhibiting optical coupling facets.

8. The method as defined in claim 7 wherein the through-etching of the silicon substrate further forms optical cavity regions, an edge of an optical cavity region formed to align with the thickest portion of the tapered evanescent coupling region.

9. The method as defined in claim 5 wherein the etching process of step h) is halted prior to reaching the silicon substrate top major surface, forming V-grooves as optical coupling facets.

10. The method as defined in claim 9 wherein the method further comprises the steps of:

i) patterning the top major surface of the silicon substrate to define locations of optical cavity regions;

j) etching the patterned top major surface to remove a predetermined portion of the exposed substrate material and form the optical cavity regions.

11. The method as defined in claim 5 wherein the method further comprises the step of:

k) coating the etched bottom major surface of the silicon substrate with an anti-reflective coating.

12. The method as defined in claim 11 wherein silicon nitride is used as the anti-reflective coating.

13. The method as defined in claim 1 wherein the method further comprises the steps of:

l) depositing a photoresist material across the top major surface of the silicon substrate;

m) patterning said photoresist surface to define locations of optical coupling facets with respect to the location of the tapered evanescent coupling region;

n) etching said patterned surface to form optical coupling facets through the top major surface of the silicon substrate.

14. The method as defined in claim 13 wherein the method further comprises the step of:

o) coating the exposed optical coupling facets with a reflective material.

15. The method as defined in claim 13 wherein the method further comprises the step of:

p) disposing at least one transmissive optical element on the bottom major surface of the silicon substrate in alignment with the optical coupling facet such that an optical signal passing through the at least one transmissive optical element will be redirected by the optical coupling facet into the tapered evanescent coupling region.

16. The method as defined in claim 13 wherein the method further comprises the step of:

q) disposing at least one reflective optical element on the bottom major surface of the silicon substrate in alignment with both the tapered evanescent coupling region and the optical coupling facet such that an optical signal reflected from the optical coupling facet will impinge the at least one reflective optical element and be redirected into the tapered evanescent coupling region.

17. The method as defined in claim 1 wherein the method further comprises the step of:

r) joining the silicon substrate to a semiconductor wafer containing a surface silicon optical waveguide layer, the silicon substrate joined to the semiconductor wafer such that the tapered evanescent coupling region is disposed directly above, and coupled to, the surface silicon optical waveguide layer.

18. The method as defined in claim 17 wherein the semiconductor wafer comprises an SOI wafer including a silicon substrate, a buried oxide layer disposed above the silicon substrate, and the surface silicon optical waveguide layer disposed above the buried oxide layer.

19. The method as defined in claim 1 wherein in performing step e) silicon dioxide is used to fill the tapered opening in the top major surface of the silicon substrate.

20. The method as defined in claim 1 wherein in performing step e) silicon nitride is used to fill the tapered opening in the top major surface of the silicon substrate.